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ABSTRACT

In this document, differences in what students expect to earn and what the census data indicates is eventually being earned at each age is considered. The difference between private returns and social rates of return is defined and reported by occupational field. Finally, the primary emphasis on why students and their families invest in graduate education is further developed and tested. The microeconomic data is from a nationwide sample of 5,346 current students, about 50 percent of whom are currently juniors and seniors who plan to attend graduate school. The rates of return take both the costs and returns of graduate education into account and permit comparisons by sex, race, educational level, and occupational objective. (Author/KE)

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FINAL REPORT

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WHY FAMILIES INVEST IN HIGHER EDUCATION

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Why Families Invest in Graduate Education

Table 1 Private Monetary Returns
Expected (Ex Ante) and Realized (Ex Post)

Table 2 Private and Social Rates of Return by Field

Table 3 Private Non-Monetary Returns

Table 4 Private Non-Monetary Returns and Total Returns
by Field

Figure 1 Why Families Invest in Graduate Education

Table 5 Why Families Invest in Graduate Education

Walter W. McMahon

PRIVATE RETURNS TO GRADUATE EDUCATION

Walter W. McMahon*

I. Introduction

Private returns that students and their families expect to receive from graduate education are an important influence on their decisions to invest their time and other resources. Private returns influence the relative choices made by individuals between investment in education, and in consumer durables, health, and other forms of capital that yield returns later in the life cycle. They are of interest as a key source of an eventual response of supplies in postgraduate job markets to changes in demands.

Since graduate education increases the monetary value of work-time, it is reasonable that it should also increase the value of consumption time. This means that there are also private non-monetary returns, and since these also have an influence on why families invest in graduate education, non-monetary returns will be considered separately later in the paper. Differences in what students expect to earn and what the Census data indicates is actually being earned at each age will be considered first, for this also affects decisions. Then the difference between private returns and social rates of return will be defined and reported by occupational field. Finally, the primary emphasis on why students and their families invest in graduate education will be further developed and tested in the concluding part of the paper.

The microeconomic data is from a nationwide sample of 5,346 current students collected as part of my broader study on Why Families Invest in Higher Education. About 50% of these are currently juniors and seniors

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planning graduate education. I have calculated the ex ante as well as the ex post private and social rates of return for the graduate degree program planned by each of these students by supplementing the data tapes with the relevant data from the 1970 Census. These rates of return take both the costs and returns of graduate education into account and permit comparisons by sex, race, educational level, and occupational objective.

Current students do not appear to be anticipating the undergraduate enrollment declines predicted for 1980 and their affects on academic versus non-academic job markets. It is decisions they have already tentatively made, however, that will affect supplies in postgraduate job markets in 1979 and 1980.

II. Rates of Return

Distinctions among rates of return and the methods by which they have been calculated need to be briefly explained before the results are considered.

Ex Ante versus Ex Post Rates of Return

Ex ante are distinguished from ex post rates of return by the fact that ex ante rates depend upon what the student expects to earn, whereas ex post rates depend upon what comparable persons who have made similar educational decisions are earning as given here by current census data.

Ex ante rates are relevant for analysis of the behavior and investment decisions made by individuals, whereas the ex post rates are the ones used to indicate whether a past investment decision has been a good one

or a bad one. Ex post rates are less useful for the analysis of the behavior of individuals, although they may of course influence expectations. The private rates, whether ex ante or ex post, can be used by families to compare the relative profitability of different kinds of investments available to them, but it is the ex post rates that are normally seen in the literature.

Private versus Social Rates of Return.

Another important distinction is between the private and social rates of return. Private rates relate private costs of graduate education incurred by the individual to the increment in returns realized by that individual. Social rates of return as technically defined currently take into account the full cost of graduate education to society, including those subsidized by taxes, endowment funds, and scholarships. The returns included in the formal definition of social rates use income before taxes, rather than the after tax income used in computing private rates. These taxes paid are not a private return but a contribution that the individual makes to society for the support of public goods and externalities, and hence to society's benefits.

Social rates are the ones relevant to educational planning. They can offer guidance to those educational administrators interested in rational resource allocation as to which graduate curricula should be subsidized and which contracted to obtain the greatest advantage for the society. However careful judgements are called for since social rates by reflecting only individual income taxes paid do not necessarily adequately reflect non-monetary equity aspects or externalities unique to some professions.

Method of Calculating Rates of Return

To explain briefly the method of calculating these monetary rates of return first note that separate rates are computed for each individual student. The rate of return is that rate which discounts the stream of net returns added by the entire advanced degree program and equates its present value to the cost of the student's time and

money resources invested. The net returns are discounted backward and the costs compounded forward to the date of graduation. The rates are marginal rates to the entire postsecondary level, rather than applying to marginal years at the graduate level alone. So the rates tend to be somewhat higher than those at the margin if students were to delay their career decisions until finishing their B.A., but to follow the normal patterns among levels and field

To obtain the stream of net returns attributable to advanced education, ex ante returns are based on what the student says he expects to earn at graduation and twenty-five years later, and ex post returns on earnings received by a person of the same race. sex, educational attainment, and occupational objective as given by census data. The ex ante age-earnings profile was constructed from the points given by the student by fitting Hanoch's age-earnings curves. From these total earnings at each age, an amount equal to what could have been earned with only a high school education at each age by a person of the same race and sex was subtracted. The net difference was multiplied by an alpha coefficient of .66 which is the one most frequently used to retain that portion of the increment to earnings that is attributable only to higher education.

The private costs of the investment needed to yield this return are computed by adding the cost of the student's time as measured by his foregone earnings[1], plus actual tuition and fees net of all grants, plus expenditures on books. Social costs add state appropriations per student,

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[1]Foregone earnings are computed by determining what is earned by a person of the same race and sex with a high school diploma for four years plus earnings of similar persons with a BA for the number of years planned in graduate school. The value of the time not invested in learning is subtracted from this, and measured by part-time job earnings cumulated to graduation. This has the effect of treating about half of all teaching and research assistantship time as straight work rather than on-the-job training. Differences in annual costs among graduate degree programs which would have a significant effect only on the social rates have not been taken into account but are currently being studied.

endowment fund and gift income per student and Federal grants to obtain the cost to the society. Private costs are lowered by grants that average $482 received by the financial aid applicants in the sample. These grants tend to raise the private rates of return slightly above what they would otherwise be, but do not affect the social rates of return.

III. Monetary Returns to Graduate Education

Private Rates of Return

The ex post private rates of return shown in Table 1 are 12% for the advanced degree programs planned by white males. This rate which has been computed from the 1970 Census data is better than the 8-10% available to students and their families on alternative types of investments. There is no evidence that the rate of return as of 1970 was lower than in earlier years, for this 12% is right between the 15% estimated by Schultz[2] and the 7% estimated by Hanoch[3] as the rate of return to graduate work using 1960 U.S. Census data.

It is interesting however, that current students consistently overestimate the earnings to be received after completion of the graduate degree programs they have chosen. The ex ante rate for white males is 16% which indicates that they expect to receive 4% more than what the 1970 Census data indicates persons receive of the same sex, race, contemplated educational attainment, and occupational choice.

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[2] T.W. Schultz, "Human Capital, Policy Issues and Research Opportunities" p. 38.

[3] G. Hanoch, "An Economic Analysis of Earnings and Schooling", Journal of Human Resources, II (3).

Table 1

Private Rates of Return to Graduate Degree Programs
Ex Ante and Ex Post, By Race and Sex

Students Planning Advanced Degrees (Currently Seniors)	n[b]	Ex Ante Private Monetary Rate	Ex Post Private Monetary Rate	Difference Ex Ante Over Ex Post
Male	460	18%	13%	5%
White	379	16	12	4
Black	54	32	15	17
Mex./Span.	20	18	17	1
Female	522	24%	16%	8%
White	349	21	15	6
Black	122	34	16	18
Mex./Span.	36	28	23	5
Controlling for Ability Level; High Ability Quartiles Only[a]:				
Male				
White	288	17	13	4
Black	6	51	20	31
Female				
White	231	20	14	6
Black	8	33	21	12

a.) The American College Testing Program Comprehensive Test Score must have been 22 or above (top 2 quartiles). It eliminates many blacks. The assumption in the lower section of the table is that this is more typical of the graduate education programs realized both by these students and in the Census data.

b.) Selected from among the 5,346 in the total sample by choosing only 1.) 1974-75 seniors, 2.) who plan graduate study, 3.) for which no items of information in column 1-3 are missing so that exactly the same students appear across each row.

It is also significant that private rates of return, both ex ante and ex post, are higher for blacks and for females. The ex post rates are higher largely because their opportunity costs are lower, which emphasizes the importance of the cost of the student's time as an important cost factor in calculating prospective returns.

But the overestimation by blacks of the returns to be expected is even more pronounced. It could be interpreted as consistent with recent studies by F. Welch[4] that have found that the rates of return for blacks schooled in the 1950's and 1960's do exceed the rates of return for whites, and that there has been a more recent upward drift. The black students in this sample clearly expect that upward drift to continue.[5]

It is also interesting that whites planning toward advanced degrees tend to expect their age-earnings profiles to be flatter than the age earnings profiles given by the 1970 Census data. It is well known that earnings peak more at later ages for those with advanced education, and less for those with less education. White males planning advanced degrees tend to overestimate the contribution their program will make to their earnings at the age at which they graduate in relation to the earnings of others of that age who have been in the labor force. The increment they will receive 25 years later is far less seriously overestimated. (The expost increments are $787 at graduation, and $4033 25 years later; the ex ante increment is $3,095 at graduation).

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[4] F. Welch, "Black-White Differences in the Returns to Schooling," AER, December 1973, 63, No.5, pp. 893-907.

[5] Most blacks in the sample are in the lower test score quartiles. The tests reflect prior schooling, and its adequacy (which may change) but in the meantime high expectations may leave some persons frustrated.

Social Rate of Return

The overall social rate of return to the graduate education programs planned by current students is 8% as shown in Table 2, Column 1. This is below the 14% ex post private rate applying to all students planning graduate work shown in Column 2, and this is typical of the 3 to 6 percentage point difference that is normally found since private returns are increased by subsidies to students and to institutions.[6]

Differences in social rates of return by occupation are shown in Column 1 but these must be examined with caution because all of the returns are not due only to education and because non-monetary externalities generated by some occupations are not included. For example, the social returns which include income taxes paid are high for managers and proprietors, but managers are selected on-the-job so Census data wouldn't include all who have had graduate training, and self-employed proprietors earnings may include some non-labor income from inherited family businesses. Social returns to medical and dental occupations of 18% are also high in relation to costs, but there are some extra costs that are not included, and the rates of return are also kept high by the restrictions on entry into these professions imposed by admission criteria and quotas. The lower social rates of return for musicians, clergy, and other fields in the bottom half of the table occur because only monetary returns are measured and would be increased if non-monetary social benefits could be included.

The Supply Response

There is some evidence of recent responses to these kinds of differences in ex post and ex ante private rates of return by students and their families.

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[6] See G. Psacharopoulos, Returns to Education, Elsevier, New York, 1973, p.5

Table 2

Social and Private Rates of Return by Graduate Degree Objective
Ranked by Size of Social Rate (Excluding Externalities) [a,b]

	Ex Post Social Monetary Rate	Ex Post Private Monetary Rate	Ex Ante Private Monetary Rate
All Fields	8	14	22
Manager (Mfg.)	21	32	24
Proprietor (Self Emp)	20	32	22
Doctor	18	27	29
Lawyer	17	24	23
Manager (Other Salaried)	11	15	32
Artist, commercial	11	13	24
Other Professional	10	19	26
Other Technical	10	13	15
Engineer	9	17	26
Accountant	9	17	28
Natural Scientist	8	11	11
Govt. Official	8	11	52
Chemist	7	9	9
Architect	6	10	31
Social Scientist	6	11	13
Social Worker	6	12	22
Teacher (El., Sec.)	5	11	20
College Professor	5	8	12
Pharmacist	4	11	9
Author, Editor	3	5	20
Med. Technician	3	6	18
Musician	0	1	21
Clergyman		-16	- 6

a.) Comparisons across each row involve the same students since all cases were excluded if any one rate was missing.

b.) Differences among occupations do not include occupation-specific externalities equity aspects. Differences in cost-per-graduate-year also are not reflected, although differences in graduate costs due to differences in the number of graduate years required or included.

Following a slowdown in 1970-71 at the end of the recession and of the artificial stimulus provided by the draft, first year full-time graduate enrollments increased in 1973-74 (over 1972-73) by 10.98% in Business Management fields[7] and by 11.6% in medicine, law and partially-graduate allied health schools. Total full time undergraduate and graduate enrollments increased by only 1.8% nationwide in 1973-74,[8] so these 10-11% rates of increase are likely to be higher than the average in response to the opportunities available in these fields.

III. Non-Monetary Returns to Graduate Education

It is also important to consider the non-monetary private returns students expect to receive from graduate education and the extent to which their decisions to invest are influenced by these.

Non-monetary returns are those returns from human capital generated later in the life cycle during leisure time hours. They have a clear theoretical basis in economics in the analysis of the value of consumption time. The idea is that later in life the student uses his consumption-time hours together with market goods to produce all final satisfactions.[9] Advanced education increases the efficiency of this non-market time, and hence its value,[10] just as it increases the productivity and hence the value of the time the student will contribute to the job market.

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[7] Computed from Graduate Study in Management, 1973-74 (and 1972-73 edition), Graduate Business Admissions Council, E.T.S. 1973, pp. 29-35.

[8] From Garland G. Parker, "College and University Enrollments in America, 1973-74", Intellect, 102 (February 1974), p. 324.

[9] See Gary S. Becker, "A Theory of the Allocation of Time", Economic Journal, September 1965.

[10] See Robert T. Michael, The Effect of Education on the Efficienty of Consumption, NBER Occasional Paper No. 116, Columbia University Press, New York, 1972

The non-monetary private returns shown on the right in Table 3 index ways that students expect their advanced education to increase the value of their consumption-time later in life. These indices then are converted into value terms by use of opportunity cost concepts that result in the non-monetary private rates of return shown in the first column of Tables 3 and 4.

Specifically, the students surveyed were first asked to report on the importance to them of each of 15 different kinds of potential benefits to their non-market time.[11] The list was not meant to be exhaustive; many additional non-monetary private benefits are discussed in the literature,[12] but almost all of these can be included within one of the 15 types of returns these students were asked to think about. The result is an ordinal index of expected non-monetary benefits specific to each student. This much is confined to ordinal utility and involves no interpersonal comparisons (and hence is a part of pure economics), but it is hopeless for summarizing the results. So a factor analysis was performed for grouping the non-monetary benefits using the factor weights into the three component factor indices shown in Table 3, and to group these in turn into a single non-monetary return index for each student. The factor weights are like market prices in that they depend on the preference expressed

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[11] For items as they appear in the original questionnaire, see Walter W. McMahon, Investment in Higher Education, D.C. Heath, Lexington, Mass., 1974, Appendix D, questions 5A-E and 6A-J.

[12] See Western Interstate Commission for Higher Education, The Outputs of Higher Education: Their Identification Measurement, and Evaluation (Boulder, Colorado, 1970) for a list (pp. 5-6) that includes private non-monetary benefits. For papers on impacts see L.C. Solomon and P.J. Taubman, Does College Matter? (New York, Academic Press, 1973).

Table 3

Non-Monetary and Total Returns Expected from Graduate Education

	Expected Non-Monetary Private Rate of Return	Total Ex Ante Mon. + N.M. Private Rate	Indices			
			Total Non-Monetary Return Index	Non-Monetary Return Component Indices		
				Consumption Time Satisfaction	Rearing Next Generation	Finding an Educated Spouse
By Degree Objective						
Associate	22%	60%	3.62	.91	2.13	.58
BA	14	39	3.50	.86	2.07	.57
Graduate	10	31	3.36	.80	1.98	.57
Graduate Objectives	10%	31%	3.36	.80	1.98	.57
Female			3.23	.78	1.91	.54
White	9	28	3.39	.78	2.05	.57
Black	16	47	3.05	.79	1.75	.51
Other	11	36	3.00	.73	1.75	.52
Male			3.52	.83	2.07	.61
White	8	23	3.64	.84	2.17	.63
Black	13	37	3.26	.83	1.86	.56
Other	7	21	3.30	.78	1.92	.60

by others for each type of non-monetary return (i.e market demand), but are unlike market prices in that they are independent of the production costs (i.e. the supply side).[13]

The results were somewhat surprising in that the most important non-monetary return expected by those planning advanced degrees is the desire "to serve the next generation by more competently rearing future children." This type of return is equally important for males and females. The second most important factor for these 1974-75 seniors is "consumption-time satisfactions," although for 1974-75 juniors (not shown here) this was the most important non-monetary return. "Consumption-time satisfaction" includes in order of importance first "a continuing interest in reading and new ideas," second, "becoming more broadminded, concerned about others, and tolerant," third "providing volunteer civic and intellectual leadership," fourth "meeting and conversing with interesting people," fifth "expected service to society," and sixth "to enjoy greater personal satisfaction." Externalities overlap with private returns to some extent, as is illustrated by the private returns students may expect from "volunteer civic leadership" and "expected service to society." But in my opinion these kinds of motivations often yield external benefits to society far in excess of the private returns.

The least important of the three broader non-monetary factors produced by the factor analysis was expected returns related to "finding

[13] To add up the "utility" each student expects from all the non-monetary returns, the factor weights of each of the fifteen types of return (i.e. the shadow prices) were multiplied by the intensity of preference for each type (i.e."very important," to "not important") that he reports for each. The result is a price times quantity type index of the non-market benefits he expects to receive.

a husband (or wife) with college-developed values." It is interesting that this is just as important for males as it is for females.

Tables 3 and 4 both reveal that the non-monetary private returns are viewed by students planning graduate degrees to be about one-half as important as expected monetary returns. Non-monetary returns are relatively more important for those not planning to go beyond the bachelors degree. Students tend to overestimate returns in relation to the census data as indicated earlier.

An even more interesting perspective is given in Table 4, which puts the overall non-monetary private rate of return at 7%; this is given when the factor weights are multiplied by the 14% private monetary rate of return computed from the 1970 census data. This method of valuing consumption time values it in terms of its opportunity cost, with the value of each hour of leisure time equal to the value of the marginal hour of work time.

The highest non-monetary private returns are expected by those planning to become self-employed proprietors (19%), managers (14%), doctors (13%), and lawyers (12%). The procedure used may overestimate the value of leisure time and expected civic service in the high earnings professions, especially in fields where there are admission restrictions and money capital barriers to entry. To get away from this, the middle column shows that expectations of high non-monetary returns motivate especially potential musicians, authors, managers, and self-employed proprietors.

Table 4

Estimates of Non-Monetary Private Returns and Total Returns to Plans for Graduate Education

Fields, Ranked by the Non-Monetary Private Rate	Private Returns			Social Returns [a]	
	Non-Monetary Private Rate of Return	Total Monetary and Non-Monetary Rate of Return	Relative Importance of Non-Mon. (to Monetary) Returns	Non-Monetary Private (Rate on Social Inv.)	Total Monetary (Social) Plus Non-Monetary (Pvt.)
Graduate, All Fields	7	21	50	4	12
Proprietor, (Self Emp.)	19	51	59	12	31
Manager (Mfg.)	14	46	43	9	25
Doctor	13	40	48	8	27
Lawyer	12	36	50	9	25
Engineer	10	27	59	5	15
Accountant	9	26	52	5	14
Manager (Other Sal.)	9	24	60	7	18
Other Professional	9	28	47	5	15
Natural Scientist	6	17	54	4	12
Other Technical	6	19	46	5	15
Architect	5	15	50	3	9
Artist (Commercial)	5	18	38	4	14
Chemist	5	14	55	4	10
Social Scientist	5	16	45	3	9
Teacher (El., Sec.)	5	16	45	2	8
Govt. Official	4	15	36	3	12
Pharmacist	4	15	36	2	8
Social Worker	4	16	33	2	9
Author, Editor	3	8	60	2	5
Med. Technician	3	9	50	2	4
College Professor	3	11	37	2	7
Musician	1	2	100	0	0
Clergyman			31	--	--

a.) Those externalities (and equity aspects) specific to each occupation that are non-monetary in nature are not included in Column 3 above, if non-monetary external benefits are defined to be those over and above pre-tax income.

The private monetary returns of 12% expected by those who plan to become college professors is above the 8% calculated from the 1970 census data. This is interesting in view of the concerns expressed during this conference about potential gluts in the academic labor markets of the 1980's. This overestimation of starting salaries does not extend to expected non-monetary private returns, however, which are lower (at 3%) than the non-monetary private returns expected by those planning to enter most other professions. Subsidies to graduate education raise total non-monetary and monetary private rates of return to 11%, above the 7% social rate however.

External benefits are, of course, very important as are equity considerations. Neither externalities or equity are the subject of this paper, but will be considered in the two papers that follow. Lest we not get too pessimistic, however, note that the overall social rate of return of 12% covering the total degree program is rather favorable when compared to alternative uses of society's resources. And it could only be higher than 12% if it were possible to add on appropriate allowances for the full scope of external benefits.

V. Why Families Invest in Graduate Education

Turning to why families invest in graduate education, the private returns that they expect, both monetary and non-monetary, turn out to be very important.

I have tested this using a two equation model that seeks to capture the essence of the decision about how much out-of-pocket expenditure and time to invest in advanced education. The model is applied separately to the student's investment, the parent's contribution, and to the total investment planned by the family because graduate education is decided

upon at least tentatively by so many at such an early stage, and the result of this separation proves to be very revealing.

The model consists of the investment demand function (or marginal efficiency of investment schedule) illustrated in Figure 1. The total investment including that in the undergraduate and graduate years is measured along the horizontal axis. The total rate of return, ex ante private monetary plus the ex ante private non-monetary rate, is measured on the vertical axis. The supply equation is a supply of total resources consisting of a supply of funds plus the supply of time allocated to the production of educational capital.

Shifts in demands and supplies in Figure 1 will be used to discuss the most significant influences on families' preliminary decisions to invest in graduate education. The full results are presented in greater detail in Table 5 for those familiar with regression analysis. The estimates there are by three stage least squares simultaneous equation methods applied first to total family investment, then to the student's investment, and finally to the parents contribution. The results are relevant to a large nationwide sample of 1974-75 seniors at public institutions. All effects turn out to have the expected sign, and all discussed can also be seen to be highly significant.

In Figure 1, first, new growth of non-academic jobs for trained persons in health, business, or research activities would, of course, increase private returns shifting the demand function outward and increase family investment in these fields. The downward slope of the demand function under any given job market conditions curtails private investment in further education when the expected returns in relation to costs get too low. The latter effect is highly significant in individual student and family behavior as can be seen in the significant negative coefficients for the private rate of return, r, in the student and family demand functions in Table 5.

Second, demand and hence the student's plan to go on later are both larger when ACT Test scores, A, obtained by entering freshmen are higher. In fact, it is almost exclusively those who are in the top two ability quartiles in the sample of 2,766 1974-5 seniors who are planning to go on.

Third, the high private rates of return expected by blacks and females in relation to the earnings given by the 1970 census data does increase their investment demand, and increases the amount of higher education they plan beyond what it would otherwise be. This can be seen in Table 5 in the effects from race, R, and sex, X. Student uncertainty, μ, about future earnings may also be seen to curtail further plans to go on with graduate education.

But it is important, and a little surprising, that some of the most powerful influences on the decision to invest in graduate education come from the effect of the availability of funds and from parental support in the earlier undergraduate years. Family disposable income (Y) is a highly significant determinant of the actual parental contribution in equation (6) and hence an important determinant of the total plan to go on for a graduate degree. It shifts the supply of funds in Figure 1 to the right.

One of the most interesting results to be observed in Table 5 is the highly significant influence of student loans, especially in view of the current Federal plan for a vast expansion of guaranteed student loans (SALLY MAE). Loans significantly reduce the parental contribution (and visa versa) shifting the burden to the student and increasing the amount he invests. (see equations (6) and (4) in Table 5). The important part however is the net effect of the availability of loans on the sum of planned parental and student investment. The net effect of loans, L, is strongly positive,

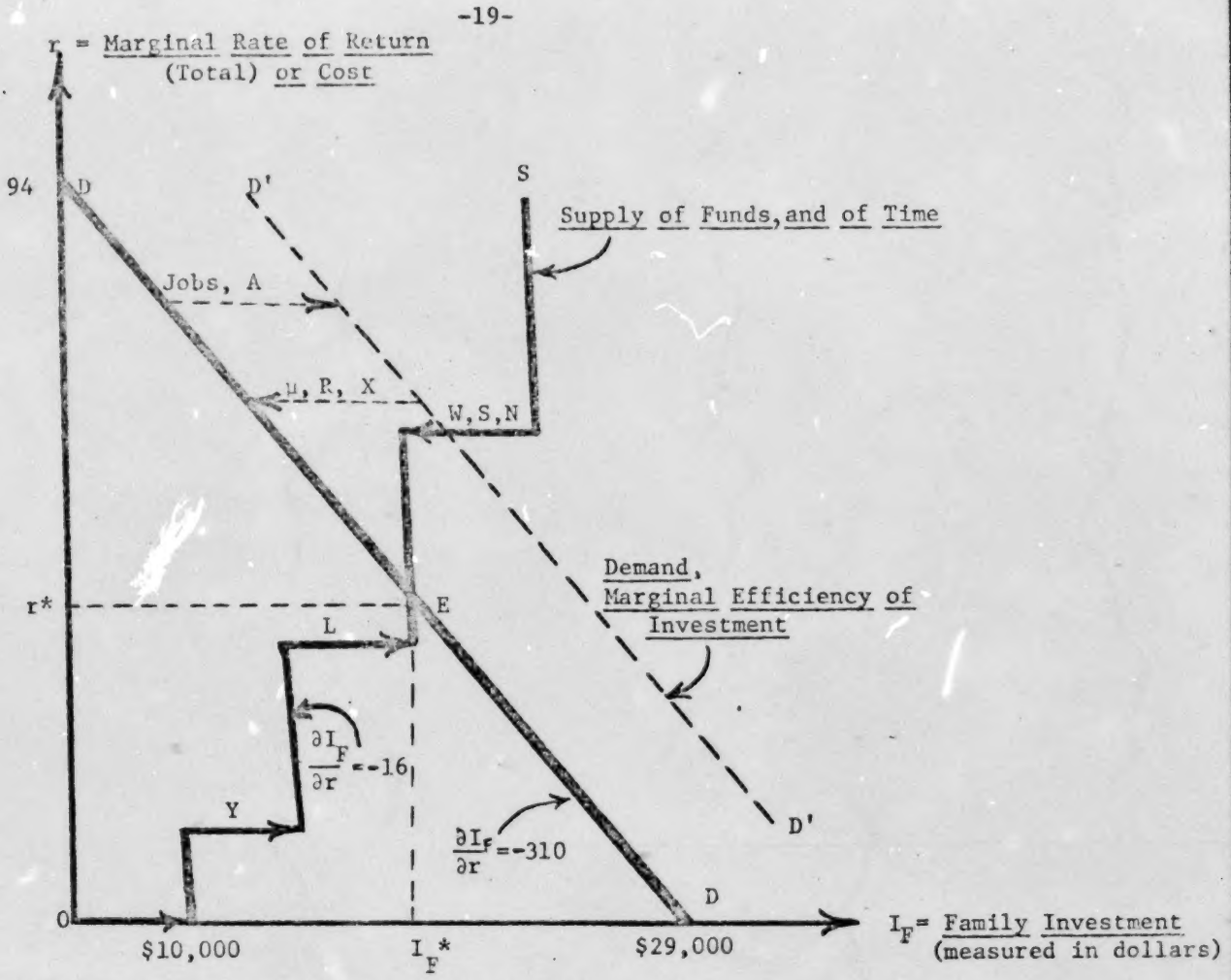

FIGURE 1 Why Families Invest in Graduate Education

Definitions of Variables in Figure 1 and Table 5

Endogenous Variables:

I_F = Total Investment by the Family in the entire degree program in dollars Parental (I_p) plus student (I_s) resources invested

r = Private Returns expected from further higher education, non-monetary plus monetary (ex ante $r_m^e + r_{nm}^e$),

Shifts in Demand; the "Elite" Approach:

Jobs = Improved job-market outlook
A = Ability, measured by ACT Test score
μ = Uncertainty of student about earnings
R = Race, White = 1, Black = 0
X = Sex, Male = 1, Female = 0
S_p = Psychological Stock of Tastes for higher education in the family measured by father's plus mother's education

Shifts in Supply of Resources; the "Egalitarian" Approach

Y = Family Disposable Income as reported by parents
L = Loans obtained by students
W = Work-time, i.e., student's part-time earnings
S = Scholarships (when aiding achievers from high income families)
N = Number of siblings

Table 5. Why Families Invest in Graduate Education

(Underlined 3SLS coefficients are significant at the .05 level or above; the t-statistics are in parentheses. 1974-75 seniors now enrolled at public institutions only. Economic variables in thousands.)
All variables are defined below Figure 1.

Total Family Investment:

(1) Demand (MEI): $I_F = \underset{(-14.40)}{-.31}\ r \quad \underset{(-3.38)}{-5.2}\ \mu \quad \underset{(-5.36)}{-5.6}\ R \quad \underset{(-3.65)}{-2.6}\ X + \underset{(2.55)}{.19}\ A + \underset{(11.71)}{29} + u_1$

(2) Supply of Resources: $I_F = \underset{(16.1)}{.23}\ Y - \underset{(3.08)}{.18}\ S + \underset{(38.69)}{.90}\ L \quad \underset{(8.27)}{-.016}\ r \quad \underset{(50.71)}{-.006}\ W \quad \underset{(-8.27)}{-.30}\ N + \underset{(52.48)}{10} + u_2$

n = 1,484 D.F. = 1,472 R^2(1SLS) = .48

Student Investment:

(3) Demand (MEI): $I_S = \underset{(-13.84)}{-.29}\ r \quad \underset{(-2.98)}{-4.4}\ \mu \quad \underset{(-5.58)}{-5.6}\ R \quad \underset{(-4.57)}{-2.2}\ X + \underset{(1.43)}{.10}\ A + \underset{(11.37)}{27} + u_3$

(4) Supply of Resources: $I_S = \underset{(5.73)}{0.7}\ Y + \underset{(51.73)}{1.1}\ L - \underset{(-9.25)}{.017}\ r - \underset{(49.91)}{.006}\ W + \underset{(37.38)}{6} + u_4$

n = 1,484 D.F. = 1,472 R^2(1SLS) = .50

Parental Contribution:

(5) Demand (MEI): $I_P = \underset{(-2.95)}{-.02}\ r - \underset{(-1.97)}{1.08}\ \mu \quad \underset{(-.390)}{-1.45}\ R + \underset{(4.70)}{.12}\ A + \underset{(5.51)}{.12}\ S_p + \underset{(.90)}{.78} + u_5$

(6) Supply of Resources: $I_P = \underset{(42.42)}{.16}\ Y \quad \underset{(-8.80)}{-.14}\ S \quad \underset{(-27.6)}{-.17}\ L \quad -.000r \quad \underset{(24.72)}{-.001}\ W \quad \underset{(-35.13)}{-.35}\ N + \underset{(73.)}{3} + u_6$

n = 1,484 D.F. = 1,472 R^2(1SLS) = .21

as may be seen in equation (2), shifting the supply of funds schedule to the right in Figure 1, and encouraging plans by 1974-75 seniors for graduate education. This net stimulus may underestimate the deterrent effect on investment later of accumulated debt, but on the other hand the tendency of loans to reduce the parents contribution and hence total investment would be less important in the graduate years where parents contributions in the past have been relatively small.

Student part-time work, W, although providing part time earnings, essentially reduces the amount of study time invested by the student in producing educational capital. The effect of part-time earnings therefore is not what might be commonly assumed, for part-time work, and a portion of the time spent as a graduate assistant, reduces the amount of study time shifting the supply of total resources schedule in Figure 1 to the left. This effect of W on family investment is highly significant as can be seen in Table 5.

Finally the parents' education, S_p, clearly influences the parental contribution, but it has no perceptible effect on the amount the student himself plans to invest. The number of siblings, N, restricts the parental contribution and shifts the total supply of family resources in Figure 1 to the left, but it also does not have a significant effect on the student's own investment.

In the future, the costs of graduate education can be expected to rise. But the growth in real family income, the fact that increasing numbers of parents have been to college, and fewer siblings because of lower birth rates, will all work in the same direction as new student loan funds as sources of increased private support enabling at least most students from the higher income groups to plan toward graduate study.

VI. Conclusion

By way of summary and conclusions, students and families do invest in graduate education in part because of expected non-monetary returns, including their "desire to serve society." But the evidence is that expected monetary returns are more important, and this edge of expected addditions to earnings over expected non-monetary returns is slightly larger for those who plan graduate work than for those who do not.

Students however overestimate the private returns they are likely to receive, a result that was somewhat surprising. It suggests that providing students with more accurate information, especially about the predicted declines in the demands for college teachers in the 1980's, may reduce the number entering academic markets in the 1980's. More information should also be provided however about the high return occupations, and the admissions criteria and money capital barriers to entry lowered in fields such as medicine, law, management, and certain proprietorships which will tend to raise the average return. It is interesting that more investment in graduate education for blacks and females can also be justified on purely efficiency grounds.

But even if students did not overestimate returns, an overall private rate of return of 14% to the total advanced degree program is a substantial continuing inducement to students and families to make decisions early to invest in graduate education. The problems these results pose for equity among income groups is also very severe, for the strong positive effects of family income, test scores, and student loans combine to give graduate education a new source of additional financing, but also a strongly elitist effect. More attention needs to be given to this whole problem of intergenerational equity.

Finally, social rates of return in the vacinity 12% for advanced education are still quite respectible. And there is always the possibility of resumed federal support for research and the growth of demands for people in new fields that new knowledge creates.